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Strategy of the Implementation of Environment-Friendly Urban Drainage System

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Abstract
The environment-friendly urban drainage is designed to reduce the impacts of the development of areas both the new and the existing ones which are at present related to the surface water drainage. The idea of environment-friendly urban drainage system is to imitate the natural system which requires effective and efficient costs, but which brings lesser negative impacts on the environment in drying up surface water through drainage network. The concept is suitable to the present and future needs of water relating to the green development. However, the implementation of this concept is still hard to make especially when it is related to an area that has been developing and densely populated. Therefore, a question is asked regarding what strategy to implement environment-friendly urban drainage system in relation to the development of urban drainage network in the future. A SWOT analysis was made to produce the strategies of implementation of such a system. The strategies can be an input for the government to implement the environment-friendly drainage system.

Keywords: drainage, environment-friendly, implementation, strategy.

1. Introduction

Environment-Friendly Urban Drainage System (EFUDS), sometimes known as Sustainable Drainage System (SuDS), or as Sustainable Urban Drainage System (SUDS), are designed to reduce the potential negative impact of new and existing developments with respect to surface water drainage discharges *(en.wikipedia.org/wiki/Sustainable_urban_drainage_systems)*. The idea behind EFUDS is to imitate the natural drainage system which reduces cost and has less negative impacts on the environment. In the natural drainage system, the surface stream will flow and be accommodated naturally and will become cleaner before being released back to the nature slowly, part of which will become groundwater. The EFUDS concept is suitable to the sustainable development need. However, it is not easy to be applied to the densely populated urban areas with limited lands. Besides, there is a problem of increasing the number of drainage infrastructure

The fact shows that most of the urban areas in Indonesia are flooded during rainy seasons and dried during dry seasons. Flood and puddle existing during rainy seasons are very disturbing to urban people. Moreover, they incur huge amount of cost which also hampers the economic activity of the people. Various ways have been implemented to reduce flood and puddle. Generally, there are two ways that have been performed to deal with them, namely handling flood and puddle without considering the environment and coping with them by taking into account of the environment (or the sustainable model). The former takes the form of flowing the flood and puddle into downstream . However this undertaking will indirectly trigger dryness during the dry seasons as well as increasing pollution on the surrounding environment and harming the ecosystem including flora and fauna. The second method is by accommodating rain water in upstream (or by retention) by producing various drip cup or by

absorbing rain water into the land (or by infiltration) by building various recharge zone construction so as to reduce the negative impacts of flood and puddle, dryness, environmental pollution and hindrance on the ecosystem. From both efforts, it can be seen that the key to gain a balance between dry and rainy seasons is to perform optimum handling during rainy seasons.

The EFUDS concept is very good and in line with the sustainable development. However, in the implementation, it will also have many obstacles. This raises a question: what is the best strategy to implement EFUDS? This paper will present the strategies in the implementation of EFUDS under the framework of SWOT analysis.

2. Methodology

SWOT analysis is employed as a methodology to produce strategies to implement EFUDS. It is a tool to evaluate Strengths (S), Weaknesses (W), Opportunities (O) and Threats (T) of an enterprise. An enterprise's strengths and weaknesses demonstrate its internal characteristics and are controllable; and its opportunities and threats are determined by external factors on which it has no direct control but can react to its own advantage (Pearce, 1992). It is a methodology which provides an enterprise with means of understanding and planning in using their strengths to exploit opportunities, and identify as well as minimise weaknesses and to defend against or sidestep any known threats. The identifications are made on S, W, O and T. After being evaluated and analysed, the strategies of implementation of EFUDS will be produced.

3. Results and Discussion

The identifications of Strengths (S), Weaknesses (W), Opportunities (O) and Threats (T) of the urban drainage system was conducted through review on literature and the collected data which can be summarised in table 1.

Table 1 Summary of results of identifications of Strengths, Weaknesses, Opportunities and Threats

SWOT	RESULT OF IDENTIFICATION	REFERENCES
Strengths	1. There have been guidance on sustainable development	(Wikipedia,2009)
	2. There have been guidance on drainage designs	(SNI,2009)
	3. Having an authority to control people	(UUD,2009)
Weaknesses	1. Law enforcement is lack	(Daroyni, 2007)
	2. Limited lands to develop drainage system	(Daroyni, 2007)
	3. Limited funding to develop drainage system	(Wiriatmoko, 2007)
	4. Condition of upper stream drainage basin was not good	(Darsono,2007) (Bianpoen,2007)
Opportunities	1. There has been new technology in infiltration	(Sansalone,2008)
	2. There has been new technology for increasing debit capacity	(Tullis et al., 2008)
	3. Integrated polder system has been developed	(Abudiarjo,2009)
	4. There have been new technology for handling garbage	(beritaiptek,2009)
Threats	1. Lack of people awareness of sustainable development	(Darmanto,2009)
	2. Lack of people roles in sustainable development	(Darmanto,2009)

Based on the results of SWOT identifications as shown in table 1, the strategies for Strengths – Opportunities (S- O) and Strengths – Threats (S – T) can be formulated in tables 2 and 3.

The Strategy for Weaknesses – Opportunities (W-O) and Weaknesses – Threats (W-T) can be formulated in tables 4 and 5.

Table 2 Strategies produced from Strengths – Opportunities

	Strength 1. There have been guidance on sustainable development 2. Having the authority to control people 3. There have been guidance on drainage system
Opportunities 1. There have been new technology in infiltration 2. There have been new technology in increasing debit capacity 3. An integrated polder system has been developed 4. There have been new technology for handling garbage	**Strategy of Strength – Opportunities** 1. Adopting guidance on the existing sustainable development and including it in the guidance for drainage design 2. Issuing regulations which impel people to use new technology in the environment friendly drainage system

Table 3 Strategies originated from Strengths – Threats

	Strength 1. There have been guidance on sustainable development 2. Having the authority to control people 3. There have been guidance on drainage system
Threats 1. Lack of people awareness of sustainable development 2. Lack of people roles in sustainable development	**Strategy of Strength – Threats** 1. Socialising the importance of sustainable development for the present and future lives 2. Issuing regulations which impel people to participate in sustainable development

Table 4 Strategies adopted from Weaknesses – Opportunities

	Weaknesses 1. Lack of law enforcement 2. Limited lands for developing drainage system 3. Limited funds for developing drainage system 4. Condition of upper stream drainage basin is not good
Opportunities 1. There have been new technology in infiltration 2. There have been new technology in increasing debit capacity 3. An integrated polder system has been developed 4. There have been new technology for handling garbage	**Strategy of Weaknesses – Opportunities** 1. Cooperating with research institution to produce new technologies which are able to support the efforts of building environment-friendly drainage system with limited lands and finance. 2. Using new technology in managing upper stream drainage basin

Table 5 Strategies derived from Weaknesses – Threats

	Weaknesses 1. Lack of law enforcement 2. Limited lands for developing drainage system 3. Limited funds for developing drainage system 4. Condition of upper stream drainage basin is not good
Threats 1. Lack of people awareness of sustainable development 2. Lack of people roles in sustainable development	**Strategy of Threats – Weaknesses** 1. Socialising the importance of sustainable drainage development for the present and future life 2. Issuing regulations which impel people to take part in sustainable drainage development especially that relating to green land / urban open space 3. Maintaining law enforcement justly and impartially

Based on the results of SWOT analysis presented in tables 1, 2, 3 and 4, it can be stated that strategies that can be adopted by the government in implementing environmentally friendly urban drainage system are as follows :

1. The government must soon adopt guidance relating to sustainable development especially in the design and building of urban drainage system.
2. The government should socialise to people concerning the importance of sustainable development for the present and future lives.
3. The government must use new technologies to manage the upper stream drainage basin
4. The government must cooperate with research institutes to produce new technologies which are able to support the efforts of building environment-friendly drainage system with limited lands and finance.
5. The government must issue regulations which impel people to playing important roles in sustainable development especially in the building of environment friendly drainages.
6. The government must practise law enforcement justly, firmly and impartially.

4. Conclusion

Based on the discussion of SWOT analysis, the strategies to implement Environment Friendly Urban Drainage System (EFUDS) can be made for the government by adopting guidance on the existing sustainable development and including them in every standard and guidance for planning issued by the government, especially in building environment friendly drainage system, familiarising the importance of sustainable development and performing law enforcement firmly, justly and impartially. The efforts will not be successful if they are not supported by the people. Therefore, the socialisation of the importance of sustainable development must be continuously maintained by providing real and simple examples.

5. References

Abudiarjo. (2009). Abudiarjo.blog.friendster.com/2007/07/banjir-polder-dan- reklamasi/ (2009, August 27)

Berita iptek. (2009). Berita-iptek.blogspot.com/2008/05/teknologi-pengolahan-sampah.html. (2009, August 27).

Bianpoen. (2007). Banjir, Bencana Apa ?. Seminar Nasional Penanganan Berkelanjutan Banjir dan Kekeringan di Jakarta Secara Terpadu. USAKTI.

Darmanto. (2007). "Community Development" Sebagai Strategi Alternatif Mitigasi Bencana. Seminar Nasional Penanganan Berkelanjutan Banjir dan Kekeringan di Jakarta Secara Terpadu. USAKTI.

Daroyni, S. (2007). Alih Fungsi Hutan dan Kelanjutan Kota Jakarta. Seminar Nasional Penanganan Berkelanjutan Banjir dan Kekeringan di Jakarta Secara Terpadu. USAKTI.

Darsono, S.L.W. (2007). Penanganan Berkelanjutan Banjir dan Kekeringan di Jakarta. Seminar Nasional Penanganan Berkelanjutan Banjir dan Kekeringan di Jakarta Secara Terpadu. USAKTI.

Ling, F.Y.Y. and Gui, Y. (2009). Strengths, Weaknesses, Opportunities and Threats : Case Sttudy of Consulting Firms in Shenzhen, China. Journal of Construction Engineering and Management. ASCE 135(7). 628-636.

Pearce, P. (1992). Construction Marketing – A Professional Approach. Telford. London.

Pitoyo. (2007). Penanganan Berkelanjutan Banjir dan Kekeringan di Jakarta Secara Multidisiplin. Seminar Nasional Penanganan Berkelanjutan Banjir dan Kekeringan di Jakarta Secara Terpadu. USAKTI.

Sansalone, J.; Kuang, X.; Ranier, V. (2008). Permeable Pavements as a Hydraulic and Filtration Interface for Urban Drainage. Journal of Irrigation and Drainage Engineering. ASCE 134(5). 666-674.

SNI : www.bsn.go.id/sni/about_sni.php (2009, August 27).

Tullis, B.P.; Olsen, E.C.; Gardner, K. (2008). Reducing Detention Volumes with Improved Outlet Structure. Journal of Irrigation and Drainage Engineering. ASCE 134(6).824-830.

UUD : id.wikipedia.org/wiki/Undang-Undang_Dasar_Republik_Indonesia_1945 (2009, August 27).

Wikipedia. (2009). en.wikipedia.org/wiki/Sustainable_urban_drainage_systems. (2009, August 27).

Wiriatmoko. (2007). Perspektif Pengendalian Tata Ruang DKI Jakarta. Seminar Nasional Penanganan Berkelanjutan Banjir dan Kekeringan di Jakarta Secara Terpadu. USAKTI